H-3232S Single-Walled Carbon Nanotube (SWCNT) Conductive Paste (NMP-Based)

1. Product Description

H-3232S is a high-performance **NMP-based conductive paste** utilizing high-purity **single-walled carbon nanotubes (SWCNTs)** as the primary conductive medium. The product is formulated with a specially developed oil-compatible dispersant and electronic-grade NMP solvent, and manufactured through advanced multi-stage dispersion technologies, including high-shear mixing and high-pressure homogenization.

Single-walled carbon nanotubes are one-dimensional nanomaterials formed by seamlessly rolling a single layer of graphene into tubular structures. With an ultra-small diameter of approximately **1–2 nm** and an extremely high aspect ratio, SWCNTs exhibit outstanding intrinsic electrical conductivity and the ability to construct continuous three-dimensional conductive networks at very low loading levels.

Through advanced catalytic purification technology, H-3232S strictly controls metal impurities and magnetic substance content, effectively minimizing potential issues caused by trace metallic contaminants, such as battery self-discharge, localized corrosion, and conductivity degradation.

The finished conductive paste features low viscosity, excellent dispersion stability, and minimal nanotube aggregation. It is highly compatible with **NMP-based lithium battery cathode manufacturing processes** and can also be directly incorporated into various oil-based conductive coating systems, including polyurethane, PVDF, acrylic, and epoxy resin systems.

With ultra-low addition levels, H-3232S improves electrical conductivity, reduces internal resistance, enhances durability, and minimizes the volume fraction occupied by conductive additives, while maintaining coating transparency, mechanical properties, and overall material performance.

2. Physical and Chemical Properties

Test Item	Specification	Unit	Test Method
Appearance	Uniform black slurry	N/A	Visual inspection
Moisture Content	≤1000	ppm	Karl Fischer Coulometric Method
Solid Content	0.80 ± 0.10	wt.%	Oven Drying Method
SWCNT Conductive Material Content	0.40 ± 0.05	wt.%	Calculation based on formulation
Oil-based Dispersant Content	0.40 ± 0.05	wt.%	Calculation based on formulation
Fe Content	≤50	ppm	ICP
Co/Ni/Cr/Cu/Zn Content	≤5	ppm	ICP
Magnetic Substance Content	≤0.2	ppm	Magnetic Rod Adsorption + ICP
Slurry Viscosity	≤3000	mPa·s	Rotational Viscometer DV2T

3. Key Advantages

1. Ultra-low Addition Level with Improved Material Performance

Compared with conventional conductive additives such as multi-walled carbon nanotubes and conductive carbon black, SWCNTs provide a significantly lower electrical percolation threshold. In lithium battery cathode systems, only 0.03–0.08 wt% addition is typically required to achieve excellent conductivity, reducing the amount of conductive additive required and allowing more space for active materials, thereby improving battery capacity and energy density. In conductive coating applications, the low loading level helps maintain coating transparency, flexibility, adhesion, and mechanical strength.

2. Superior Electrical Conductivity for High-Power Applications

The unique one-dimensional tubular structure of SWCNTs enables the formation of continuous conductive pathways with excellent electron transport capability. Compared with conventional carbon nanotubes and conductive carbon black, SWCNTs provide much higher intrinsic electrical conductivity, effectively reducing electrode and coating resistance. This makes H-3232S suitable for high-rate lithium batteries, fast-charging applications, antistatic coatings, and electromagnetic shielding materials.

3. Low Viscosity System with Excellent Processing Compatibility

H-3232S features a low viscosity of ≤3000 mPa·s and excellent flowability. The stable dispersion system reduces the risk of secondary aggregation during slurry preparation and coating formulation. The product provides good processing performance in spray coating, roller coating, and blade coating processes, minimizing coating defects such as particles, pinholes, and shrinkage marks. It is also suitable for automated continuous production systems.

4. Ultra-low Moisture Content for Oil-Based Applications

The moisture content of H-3232S is strictly controlled at ≤1000 ppm, ensuring excellent compatibility with moisture-sensitive oil-based systems. In lithium battery applications, low moisture content helps prevent gas generation and performance degradation caused by moisture reactions with electrode materials and PVDF binders. In conductive coating systems, it helps avoid hydrolysis, whitening, adhesion loss, and other stability issues.

5. Ultra-low Metal Impurity Content for Enhanced Safety and Durability

The contents of Fe, Co, Ni, Cr, Cu, Zn, and magnetic substances are precisely controlled through advanced purification processes. The low impurity level reduces the risk of micro-short circuits and self-discharge in lithium batteries while preventing discoloration and localized electrochemical corrosion in conductive coatings. This makes the product suitable for high-reliability energy storage systems and precision electronic applications.

6. NMP Solvent System with Broad Resin Compatibility

H-3232S uses electronic-grade NMP as the dispersion medium, providing excellent compatibility with common oil-based binders and resin systems, including PVDF, polyurethane, acrylic resin, and epoxy resin. The product can be directly incorporated into existing lithium battery slurry preparation processes and conductive coating formulations without requiring additional equipment modification.

7. Excellent Formulation Flexibility and Blending Compatibility

H-3232S can be used as a standalone conductive additive or combined with other conductive materials such as multi-walled carbon nanotubes, conductive carbon black, and graphene. This provides flexibility for balancing cost, conductivity, transparency, and mechanical performance, allowing customization for different applications including lithium batteries, conductive inks, electromagnetic shielding coatings, and polymer composites.

4. Applications

H-3232S is an **NMP solvent-based SWCNT conductive paste** with excellent compatibility with oil-based resins, binders, and electrode materials. It is widely used in lithium batteries, electrochemical energy storage devices, conductive coatings, and functional composite materials.

2.1 Oil-Based Lithium Battery Cathode Systems

Suitable for:

- Lithium iron phosphate (LFP)
- Lithium cobalt oxide (LCO)
- Medium and high nickel ternary materials (NCM/NCA)

Applicable in:

- Power lithium batteries
- Fast-charging consumer batteries
- Long-life energy storage lithium batteries

H-3232S can be used alone or combined with conductive carbon black, multi-walled carbon nanotubes, and graphite to improve electrode conductivity. It is compatible with existing NMP-based slurry preparation and coating production processes.

2.2 Functional Conductive Coatings and Polymer Composite Materials

Applicable for:

- Antistatic coatings for plastic housings, electronic components, packaging films, and PCB carrier tapes
- Electromagnetic shielding coatings for communication equipment housings, flexible shielding films, and electronic shielding tapes
- Transparent or semi-transparent conductive inks for flexible circuits, touch panels, heating films, and sensor electrodes
- Conductive polymer composites, including conductive plastics, conductive rubber, and thermally/electrically conductive composite films
- Conductive anti-corrosion primers for metal structures

2.3 Other Electrochemical Devices

Suitable for electrochemical energy storage systems requiring NMP-based formulations, including:

- Supercapacitors
- Capacitive batteries
- Lithium-sulfur batteries

5. Packaging and Shipping

5.1 Packaging Specifications

Packaging Size	Container	Pallet Arrangement
20 kg	20 L white plastic pail with pull-ring lid	9 pails per layer, 2 layers per pallet
200 kg	200 L blue plastic drum	4 drums per layer, 1 layer per pallet
1000 kg	HDPE IBC container	1 container per pallet

6. Storage Conditions and Shelf Life

1. Store the product in a tightly sealed container. The recommended storage temperature is **5–50°C** with relative humidity ≤95% RH. Avoid direct sunlight, excessive heat, freezing conditions, and exposure to moisture or humid environments.
2. Under recommended storage conditions and unopened original packaging, the shelf life is **6 months from the production date**.
3. After opening, the product may absorb moisture from the atmosphere. It is recommended to use the product as soon as possible. Remaining material should be stored under nitrogen protection and reused only after confirming moisture content, viscosity, and dispersion stability.

7. Recommended Usage

7.1 Recommended SWCNT Addition Level

Lithium Battery Oil-Based Cathode Systems

Battery System	Recommended Addition
LFP	0.03–0.05 wt%
LCO	0.03–0.06 wt%
NCM/NCA	0.03–0.08 wt%

Conductive Coatings and Composite Materials

Application	Recommended Addition
Antistatic Coatings	0.02–0.06 wt%
Electromagnetic Shielding Coatings / Conductive Inks	0.04–0.10 wt%
Conductive Plastics / Rubber	0.05–0.12 wt%

The optimal addition level should be adjusted according to substrate resistivity, coating thickness, transparency requirements, and target conductivity. When combined with other conductive additives, the dosage of H-3232S can be reduced accordingly.

7.2 Handling Guidelines

Before use, inspect the container carefully. Any leakage indicates possible sealing failure, which may result in product loss or increased moisture content. Leaking containers should be tested before use, and abnormal batches should not be introduced into production.

For lithium battery slurry preparation, opening and feeding operations should be conducted in a dry environment with humidity below 10% RH or under 5N nitrogen protection. Conductive coating formulation should also minimize exposure to humid air. Mixing tanks, pipelines, and equipment contacting the slurry should remain clean and dry, and corrosion-resistant materials are recommended to prevent metal contamination.

Open only the required amount for each production batch. Long-term exposure to air should be avoided. Remaining slurry should be sealed under dry conditions with nitrogen protection and tested before reuse.

Operators should take appropriate protective measures during handling to prevent splashing. Spilled material should be collected and disposed of according to local regulations.

Due to the strong van der Waals forces between SWCNT molecules, aggregation may occur. Customers are advised to verify compatibility with their high-shear and high-pressure dispersion processes to ensure uniform dispersion and maximize conductive performance.

Disclaimer

1. *Actual product specifications shall be based on the batch inspection report supplied with each shipment. This technical datasheet is provided for reference only.*
2. *The performance data and application recommendations are based on laboratory testing and production validation. Customers should conduct their own compatibility and process evaluations before commercial production.*
3. *The company does not guarantee performance under specific customer formulations or application conditions. Any variation caused by formulation, processing conditions, or environmental factors should be evaluated by the customer.*
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